

REMARKS

Claims 1-8, 10-12 and 15-18 stand rejected, with claims 9, 13, 14 and 19 objected to in the outstanding Official Action. Claims 1, 9, 13, and 19 have been amended and newly written claims 20 and 21 offered for consideration. Accordingly, claims 1-21 are the claims remaining in this application.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page(s) is captioned "**Version With Markings To Show Changes Made.**"

The Examiner's acknowledgment of applicants' claim for priority and receipt of the certified copies of the priority documents is very much appreciated. Additionally, the Examiner's initialing and considering the references noted in applicants' Information Disclosure Statement is appreciated.

The drawings stand objected to as including a reference sign not mentioned in the application, i.e. element 14 in Figure 23. Applicants have amended the specification on page 28 to indicate that beamsplitter 14 is disclosed in Figure 23. Several other minor corrections to item numberings have been included in the above amendment to pages 27 and 28.

The Patent Office objects to the Abstract. It is also appreciated that the Examiner has brought the Abstract the applicant's attention. It is noted that the objection to the Abstract appears to be an indication that the originally filed specification and drawings (transmitted from WIPO) do not meet the formality requirements of the U.S. Patent and

Trademark Office. The Patent Office is reminded that the U.S. Patent and Trademark Office must comply with all articles of the Patent Cooperation Treaty (PCT) including Article 27. It has been held that:

“if the rule and interpretation of the PTO conflicts with the PCT, it runs afoul of Article 27 of the PCT which provides in part:

- (1) No national law shall require compliance with requirements relating to the form or contents of the international application different from or additional to those which are provided for in this Treaty and the Regulations.”
Caterpillar Tractor v. Commissioner, 231 USPQ 590, 591 (EDVA 1986).

The Patent Office has referenced this decision in the Official Gazette dated September 9, 1986 (1070 TMOG 5).

As a consequence, the Patent Office (including the Chief Draftsman's Office) may not require Abstract changes as long as the originally submitted documents comply with the PCT requirements. Inasmuch as this specification was forwarded by WIPO, by definition, it meets the PCT requirements (it is not forwarded until it meets PCT requirements.). Therefore, the objection to the Abstract is respectfully traversed and reconsideration thereof is respectfully requested.

Notwithstanding the above, applicant has included a retyped Abstract on a separate sheet, and has added headings and subheadings to the specification.

The disclosure is objected to, as element 21 on pages 27 and 28 should have been cited as element 13. This portion of the specification has been corrected.

Claims 1, 4, 5, 7, 8, 11, 12 and 15-18 stand rejected under 35 USC §102 as being anticipated by Park et al (U.S. Patent 5,526,336). Applicants' invention is the use of a

diffraction grating that is distorted according to a quadratic function so as to cause images to be formed under various focus conditions, where those images are spatially separated in a direction having a non-zero component perpendicular to the optical axis (see claim 1 amended).

The Examiner suggests that Park discloses in Figure 7 an apparatus for producing "a plurality of spatially separated images." The Examiner does not indicate how or where Park teaches a distorted diffraction grating or more specifically a diffraction grating that is distorted in accordance with a quadratic function. Without this specific structure, Park cannot anticipate or even render obvious applicants' independent claim 1 or claims dependent thereon.

It is noted that Park teaches various embodiments of an optical pick-up device and, in one embodiment (Fig. 2), a Fresnel lens 4 and an objective lens 5 are separately controlled so as to focus a beam onto a disk. Reflected radiation passes through the objective lens and the Fresnel lens passes through beamsplitter 3 and is detected by optical detector 11. There is no mention that the diffraction grating is distorted or that it is distorted according to a quadratic function so as to cause images to be spatially separated in a direction having a component perpendicular to the optical axis.

Indeed, Figure 2 does not indicate that the images are spatially separated at all. In fact, column 3, at lines 51-55, suggests that the images are not separated at all and instead the tracks from a single image are only electronically separated (implying that the images are not separated. There certainly is no disclosure of spatial separation of images.

The Examiner refers to the discussion in Park at column 4, lines 12-16 (paragraph bridging pages 2 and 3 of the Official Action) and suggests that with respect to Figure 7, this teaches a distorted diffraction grating according to a quadratic function. Figure 7 in Park shows an optical pick-up arrangement and column 4, lines 12-16 discuss the focusing of light from a light source onto an optical disk by adjusting the diffraction rate of a Fresnel lens 4. There is no disclosure of distorting the Fresnel lens to a quadratic function or to use that lens to cause images to be formed which are spatially separated in a direction perpendicular to the optical axis.

The Examiner's independent discussions with respect to claims 4, 5, 7, 8, 11, 12 and 15-18 is appreciated, although the primary structures and structural interrelationships specified in applicants' independent claim are not present, and therefore these dependent claims cannot possibly be anticipated without a specific disclosure in the Park reference.

Because the structures set out in claims 1, 4, 5, 7, 8, 11, 12 and 15-18 are not present in Park, the rejection under 35 USC §102 necessarily fails.

Claims 2, 3 and 6 stand rejected under 35 USC §103 as unpatentable over Park in view of Lee (U.S. Patent 5,721,629). Inasmuch as claims 2, 3 and 6 ultimately depend from claim 1, the above comments distinguishing claim 1 over the Park reference are herein incorporated by reference. While the Examiner cites the Lee reference, and in particular column 3, lines 35-67, there is no indication that Lee teaches the distorted diffraction grating where it's distorted in accordance with a quadratic function or that it's distorted in a manner sufficient to cause spatially separated images in a direction perpendicular to the optical axis. If the distorted diffraction grating is not present in Park

or in Lee, the combination of these two references cannot disclose or render obvious such a grating. Therefore, the subject matter of claims 2, 3 and 6 adding further details to the combination of elements set out in claim 1 cannot be obvious in view of the Park and Lee combination.

Claim 10 stands rejected under 35 USC §103 as unpatentable over Park in view of Torok (U.S. Patent 3,861,784). Again, since claim 10 depends from claim 1, the above comments with respect to the Park reference are herein incorporated by reference. The Examiner does not indicate that the Torok reference teaches applicants' claimed diffraction grating which is distorted according to a quadratic function, thereby forming spatially separated images. Inasmuch as this is not disclosed in either Park or Torok, the combination of these two references does not somehow magically make the recited structure and structural interrelationship appear. As a result, there is no basis for a rejection of claim 10 under the provisions of 35 USC §103 over the Park/Torok combination and any further rejection thereunder is respectfully traversed.

The Examiner's indication of allowable subject matter in claims 9, 13, and 19 is very much appreciated. These claims have been rewritten in independent form incorporating the limitations of original claim 1 and therefore would appear to be allowable.

The Examiner indicates that claim 14 would be allowable if rewritten "to overcome the claim objection set forth in this Office Action." Applicants can find no claim objection to claim 14 in this Official Action and presumes that this was an inadvertent inclusion of a non-applicable statement in the preparation of the Official

Action. Should the Examiner have intended some objection to claim 14, he is respectfully requested to clarify the objection. It is noted that claim 14 depends from claim 13, which applicants have already rewritten in independent form rendering it in condition for allowance.

In view of the above, it is submitted that claims 9, 13, 14 and 19 are allowed, as they have been rewritten as suggested by the Examiner.

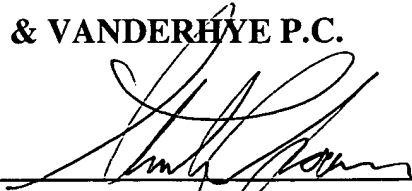
Applicants also offer two newly written dependent claims dependent from amended claim 1, which recite a wavefront analyzer, as well as a passive ranging device wherein both systems include the apparatus of claim 1. Consideration of newly added claims 20 and 21 is respectfully requested.

Having responded to all objections and rejections set forth in the outstanding Official Action, it is submitted that claims 1-21 are in condition for allowance and notice to that effect is respectfully solicited. In the event the Examiner is of the opinion that a brief telephone or personal interview will facilitate allowance of one or more of these claims, he is respectfully requested to contact applicants' undersigned representative.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

Page 1, between the Title and line 1:

BACKGROUND OF THE INVENTION

1. Field of the Invention

Page 1, above the paragraph beginning at line 6:

2. Discussion of Prior Art

Page 3, above the paragraph beginning at line 2:

SUMMARY OF THE INVENTION

Page 5, above the paragraph beginning at line 10:

BRIEF DESCRIPTION OF THE DRAWINGS

Page 7, above the paragraph beginning at line 15:

DETAILED DISCUSSION OF EMBODIMENTS

Page 27, substitute the paragraph beginning at line 20, with the following rewritten paragraph:

Complete System

Using two gratings of the type described in this invention a complete system for illumination and reading from a multi-layer optical data storage medium, with no moving parts and automatic spherical aberration correction can be described. The system is

shown schematically in Figure 23. Light from the source [21] 13 passes through a grating 4b of the type described in the paragraph above (and Figure 18), which produces multiple on-axis, spherical aberration corrected foci corresponding to the different data layers 5, 6 and 7. Light reflected from the data layers passes through a grating 4a of the type shown in Figure 15c with spherical aberration correction, which produces spatially separated images of the different data layers on plane B. It is well known that a polarisation sensitive beamsplitter 14 and polarisation rotating plates can be used to minimise losses in such a system. Numeral 1 is used generally to designate an optical system.

Page 28, substitute the paragraph beginning at line 4, with the following rewritten paragraph:

In such a system the terms “object plane” and “image plane” can be confusing: layers 5, 6 and 7 are “image planes” according to the invention with respect to an “object plane” containing illumination source [21] 13 and are “object planes” with respect to “image plane” B. For convenience we say that the “image planes” of one apparatus according to the invention are coincident with the “object planes” of the other.

Page 28, substitute the paragraph beginning at line 9, with the following rewritten paragraph:

Other embodiments of the complete system will be obvious to the skilled person: for example the illumination source [21] 13, grating 4b and associated optical system 1

could be located on the same axis as the imaging plane B and grating 4a, located on the other side of 'object' planes 5, 6 and 7. In such an embodiment, planes 5, 6 and 7 are illuminated in transmission.

IN THE CLAIMS

1. (Amended) An apparatus for producing simultaneously a plurality of spatially separated images from an object field comprising:

an optical system arranged to produce an image associated with a first focus condition;

a diffraction grating arranged to produce, in concert with the optical system, images associated with each diffraction order and

means for detecting the images,

wherein the optical system, diffraction grating and detecting means are located on an optical axis and the diffraction grating is located in a suitable grating plane and the diffraction grating is distorted [substantially] according to a quadratic function so as to cause the images to be formed under various focus conditions and said images spatially separated in a direction having a non-zero component perpendicular to the optical axis.

9. (Amended) An apparatus [according to claims 1] for producing simultaneously a plurality of spatially separated images from an object field comprising:

an optical system arranged to produce an image associated with a first focus condition;

a diffraction grating arranged to produce, in concert with the optical system,
images associated with each diffraction order and
means for detecting the images,
wherein the optical system, diffraction grating and detecting means are located on
an optical axis and the diffraction grating is located in a suitable grating plane and is
distorted substantially according to a quadratic function so as to cause the images to be
formed under various focus conditions whereby the diffraction grating comprises two
gratings sensitive to different polarisations and arranged such that the diffraction orders
produced by said gratings are spatially separated, *along same axis*

13. (Amended) [The] An apparatus [of claim 1] for producing simultaneously a
plurality of spatially separated images from an object field comprising:

an optical system arranged to produce an image associated with a first focus
condition;

a diffraction grating arranged to produce, in concert with the optical system,
images associated with each diffraction order and

means for detecting the images,

wherein the optical system, diffraction grating and detecting means are located on
an optical axis and the diffraction grating is located in a suitable grating plane and is
distorted substantially according to a quadratic function so as to cause the images to be
formed under various focus conditions and *(adapted for)* forming images on a plurality of
image planes, from a single object plane. *→ not this* *to the diff*

19. (*Amended*) An apparatus [according to claim 1] for producing simultaneously a plurality of spatially separated images from an object field comprising:

an optical system arranged to produce an image associated with a first focus condition;

a diffraction grating arranged to produce, in concert with the optical system, images associated with each diffraction order and

means for detecting the images,

wherein the optical system, diffraction grating and detecting means are located on an optical axis and the diffraction grating is located in a suitable grating plane and is distorted substantially according to a quadratic function so as to cause the images to be formed under various focus conditions and further including a dispersive system for introducing an offset to an input beam of radiation, said offset being perpendicular to the optical axis and proportional to the wavelength of the input radiation, whilst leaving the beams at each wavelength following parallel paths.

--20. (*New*) A wavefront analyser including an apparatus for producing simultaneously a plurality of spatially separated images from an object field according to claim 1.

21. (*New*) A passage ranging device including an apparatus for producing simultaneously a plurality of spatially separated images from an object field according to claim 1.--